

TR/TES/C-II/V(A)/13

CIVIL ENGINEERING

Paper : II

V(A)-Degree

Full Marks – 200

Time – Three hours

The figures in the margin indicate full marks for the questions.

Candidates are required to give their answers in their own words as far as practicable.

Scientific calculators are allowed.

Assume data reasonably, if required.

GROUP – A

6×15=90

(Answer 15 questions only, restricting each answer within 40 words. If answers are more than 15, excess written at the end will not be evaluated.)

1. Illustrate some main comparative advantage/disadvantage of a centrifugal pump over a reciprocating pump.
2. What is the dimensional homogeneity of an equation ?
3. What is Vena Contracta ?

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4. Point out the advantage of a triangular notch over a rectangular notch.
5. What are three point problem and method of solving it in surveying ?
6. What is Solar and Sidereal time ? What is the time difference between a mean sidereal day and mean solar day ? How many times heavenly bodies cross the observer's meridian each day ?
7. Name the common methods of Irrigation. Which method uses least amount of water ?
8. Define unit hydrograph and what is the basic principle of the unit hydrograph ?
9. Sequentially name the primary processes involved in a water treatment plant. Also name some other auxiliary methods required to perform specific functions.
10. How a trickling filter acts in treating sewage ?
11. Write a short note on sanitary land fill.
12. In a retaining wall when active and passive earth pressure develop ? In which case the direction of resisting force will be downward ?

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13. (a) Classify the piles based on their function and use.
(b) Classify the piles based on the material used.
14. Explain the importance of highway drainage.
15. What is seal coat and its function ?
16. Describe the various remedial measures adopted for prevention of water logging of agricultural land.
17. Classify the valves for pipes to control supply according to the motion of the valve element along with examples.
18. How is GPS used in Surveying ?

GROUP – B

2×40=80

(From the four alternatives provided with each question, choose the correct answer for 40 questions only. If answers are more than 40, excess written at the end will not be evaluated.)

1. In a Pitot tube the conversion of energy is
 - (a) Pressure energy into kinetic energy
 - (b) Kinetic energy into velocity energy
 - (c) Kinetic energy into pressure energy
 - (d) None of these.

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2. The maximum vacuum created at the summit of a syphon is
(a) 2.7m of water (b) 7.4m of water
(c) 5.5m of water (d) None.
3. The ratio of the inertia and gravitational force acting in any flow, ignoring other forces, is called
(a) Euler number (b) Froude number
(c) Reynold number (d) Weber number.
4. Equation of continuity of flow is based on the principle of conservation of
(a) mass (b) momentum
(c) force (d) None of these.
5. The flow in open channel is said to be subcritical if the Froude number is
(a) less than 1.0 (b) equal to 1.0
(c) greater than 1.0 (d) None of the above.
6. In a pipe line a Surge tank is provided
(a) To relieve the pressure due to water hammer
(b) To provide additional water head
(c) To overflow the pipe line
(d) To remove the frictional loss.

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7. In the most economical rectangular section of a channel, the depth is equal to

- (a) $\frac{1}{4}$ th of the width
- (b) 3 times the hydraulic radius
- (c) $\frac{1}{2}$ the width
- (d) None of the above.



8. In an open channel when a rapidly flowing stream abruptly changes to slowly flowing stream, causing a distinct rise to liquid surface, the phenomenon is

- (a) Water Hammer
- (b) hydraulic jump
- (c) Critical discharge
- (d) None of the above.

9. Aerobic bacteria does not

- (a) flourish in the presence of free oxygen
- (b) consume organic matter as their food
- (c) oxidise organic matter in sewage
- (d) None of the above.

10. The pH value of fresh sewage is usually

- (a) equal to 7
- (b) more than 7
- (c) less than 7
- (d) equal to zero.

11. Traps

- (a) are water seals which prevent the entry of foul gases
- (b) are used to trap the rats entering sewers
- (c) dissolve the foul gases
- (d) create syphonic action to increase the quick disposal of sewerage.

12. In the activated sludge process

- (a) aeration is continued till stability
- (b) aeration is done with an admixture of previously aerated sludge
- (c) sludge is activated by constant stirring
- (d) water is removed by centrifugal action.

13. For drainage pipes in buildings the test applied before putting them to use, is

- (a) water test
- (b) smoke test
- (c) straightness test
- (d) all the above.

14. Irrigation canals are generally aligned along

- (a) ridge line
- (b) contour line
- (c) valley line
- (d) straight line.

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15. A deficit of sediments in flowing water may cause a river

- (a) meandering type (b) aggrading type
(c) degrading type (d) sub-critical type.

16. Meandering of a river generally occurs, in

- (a) rocky stage (b) delta stage
(c) boulder stage (d) trough stage.

17. Biochemical Oxygen Demand (B.O.D.) of safe drinking water must be

- (a) 15 (b) 10
(c) 5 (d) 0.

18. For plain chlorination of water, the quantity of chlorine used, is

- (a) 0.2 mg/litre (b) 0.3 mg/litre
(c) 0.4 mg/litre (d) 0.5 mg/litre

19. Filtration of water is done to remove

- (a) colour (b) odour
(c) turbidity (d) pathogenic bacteria.

20. In a rapid gravity filter

- (a) raw water from the source is supplied
- (b) filtered raw water is supplied
- (c) raw water passed through coagulation tank is supplied
- (d) None of these

21. The minimum value of camber provided for the bituminous surfaces till 1960, is

- (a) 1.7% (b) 2.5%
- (c) 2.0% (d) 3.5%

22. Which of the following is considered as the highest quality construction?

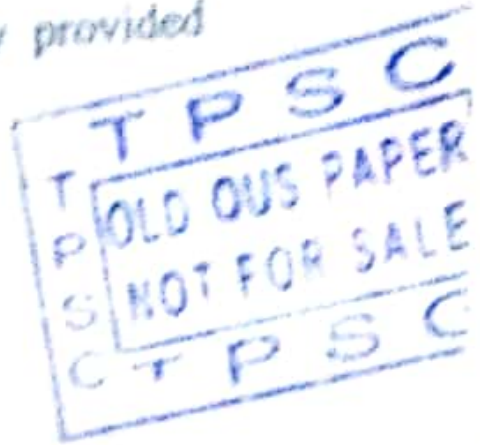
- (a) Mastic asphalt (b) Sheet asphalt
- (c) Bituminous carpet (d) Bituminous concrete

23. In an ideal transition curve, the radius of curvature

- (a) is constant
- (b) at any point is directly proportional to its distance from the point of commencement
- (c) is inversely proportional to the radius of main curve
- (d) is inversely proportional to the radius of main curve

24. Floating gradients are generally provided

- (a) along maximum gradients
- (b) along minimum gradients
- (c) at summit curves
- (d) at valley curves



25. To compensate the loss of tractive force of vehicles along curves of radius R , the percentage reduction of gradient, is

- (a) $50/R$
- (b) $75/R$
- (c) $100/R$
- (d) $125/R$

26. The useful moisture of a soil depends on

- (a) Field capacity
- (b) Moisture content at permanent wilting point
- (c) Difference between field capacity and permanent wilting point
- (d) Saturation capacity

27. If Δ is the depth of water in metres, B is the number of days in base period and D is the duty in ha./cumec, then

- (a) $\Delta = 8.64 D/B$
- (b) $B = 8.64 \Delta/D$
- (c) $D = 8.64 \Delta/B$
- (d) $\Delta = 8.64 B/D$

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28. When a canal is carried below a natural drainage, such type of structure is called

- (a) syphon (b) syphon aqueduct
(c) aqueduct (d) superpassage

29. The relationship between void ratio (e), and porosity (n) is

- (a) $n = (1+e)/(1-e)$ (b) $e = (1+n)/(1-e)$
(c) $n = e/(1-e)$ (d) $e = n(1+e)$

30. Plasticity index is the difference between

- (a) The liquid limit and plastic limit
(b) The plastic limit and shrinkage limit
(c) The liquid limit and shrinkage limit
(d) None of the above.

31. The shear strength of a plastic un-drained clay results from

- (a) Inter granular friction
(b) Internal friction
(c) Cohesion
(d) None of the above.

32. The maximum net pressure intensity causing shear failure of soil is known as

- (a) Safe bearing capacity
- (b) Net safe bearing capacity
- (c) Ultimate bearing capacity
- (d) Net ultimate bearing capacity

33. If the staff is not held vertical at a leveling station, the R.L. calculated from the observation would be

- (a) True R.L
- (b) Less than true R.L
- (c) More than true R.L
- (d) None of the above.



34. The imaginary line passing through the intersection of cross hairs and the optical centre of the objective is known as

- (a) The line of sight
- (b) The line of collimation
- (c) The axis of telescope
- (d) None of the above.

35. The back sight of a staff held on B.M point A having R.L 300.00m is 2.685m and the fore sight on staff held at B is 1.345m. The R.L of point B is

- (a) 302.685m
- (b) 301.345m
- (c) 302.585m
- (d) 301.340m

36. A series of close contours of values decreasing toward the centre of the series represents a

- (a) A hill
- (b) A depression without an outlet
- (c) A pass
- (d) A river bed

37. A deflection angle in a traverse is

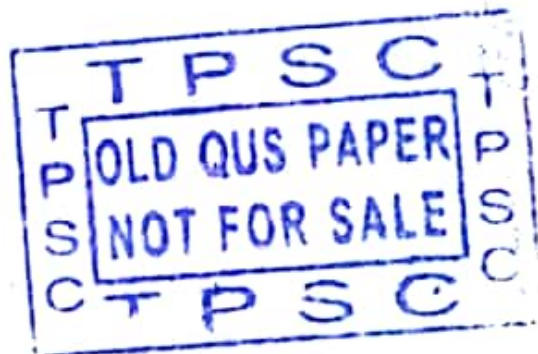
- (a) Less than 90°
- (b) More than 90° but less than 180°
- (c) The difference between included angle and 180°
- (d) The difference between 360° and included angle.

38. Pick up the incorrect statement from the following :

- (a) Maximum value of dry density is obtained at optimum water content.
- (b) At low value of water content most soils tend to be stiff.
- (c) At high water content, the dry density decreases with an increase of water content.
- (d) None of the above.

39. According to IS specification, the minimum depth of foundation in sand and clay should be respectively

- (a) 600 mm and 700 mm
- (b) 800 mm and 900 mm
- (c) 1000 mm and 800 mm
- (d) 1000 mm and 1200 mm



40. The desirable length of overtaking zone as per IRC recommendation is equal to

- (a) $1 \times$ Overtaking Sight Distance
- (b) $2 \times$ Overtaking Sight Distance
- (c) $3 \times$ Overtaking Sight Distance
- (d) $5 \times$ Overtaking Sight Distance

41. A hyetograph is a graphical representation of
- (a) Rainfall intensity and time
 - (b) Rainfall depth and time
 - (c) Discharge and time
 - (d) Cumulative rainfall and time
42. The most suitable chemical which can be applied to the water surface for reducing evaporation is
- (a) Methyl alcohol (b) Ethyl alcohol
 - (c) Cetyl alcohol (d) Butyl alcohol
43. An artesian aquifer is the one where
- (a) Water surface underground is at atmospheric pressure
 - (b) Water is under pressure between two impervious strata
 - (c) Water table serves as upper surface of zone of saturation
 - (d) None of the above.
44. The relationship between Probability (P) and Recurrence Interval (T) is
- (a) $PT = 1$ (b) $PT^2 = 1$
 - (c) $P/T = 1$ (d) $P/T^2 = 1$

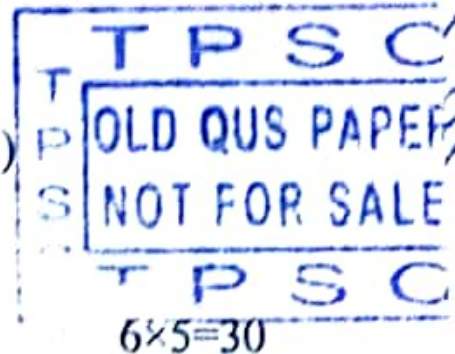
45. For an annual flood series arranged in descending order of magnitude, the return period for a magnitude listed at position period m in a total data N is

(a) $(n+1)/m$

(b) m/N

(c) $m/(N+1)$

(d) $N/(m+1)$



GROUP - C

(Answer all the numerical questions.)

1. A trapezoidal channel of most economical section has side slope 1:1. It has a bed slope of 1 in 2000 and required to discharge 8 cumecs. Design the section using Manning's formula. Take Manning's $N = 0.015$.
2. The speeds of overtaking and overtaken vehicles are 60 and 40 kmph respectively, on a two way traffic road. If the acceleration of overtaking vehicle is 3.60 kmph per second, calculate the safe overtaking sight distance.
3. The liquid limit and shrinkage limit of a soil sample is 52% and 18%. The volume of the soil sample is 39.5 cm^3 at liquid limit and 24.2 cm^3 at shrinkage limit. Find the true specific gravity.

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4. Average June pan evaporation of a reservoir is 25 cm. The reservoir has a storage capacity of 1140 million m^3 . At that capacity, the water surface has an area of 4610 m^2 .

(i) Estimate the average June evaporation volume that would occur with a full reservoir. Use a pan coefficient of 0.7.

(ii) In a metropolitan city of India, the evaporation loss is equivalent to supplying domestic water for how many people ?

(iii) Assuming a June irrigation demand, the evaporation loss is equivalent to irrigating how many ha. of crop land ?

5. The following data have been noted from the census department.

YEAR	POPULATION
1980	8000
1990	12000
2000	17000
2010	22500

Find the probable population in the year 2020, 2030 and 2040 by Geometrical increase method.

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